

## A. WHITMAN MILLER

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### PROFESSIONAL PREPARATION

Earlham College	Biology	B.A., 1984
University of California, Los Angeles	Biology	M.A., 1995
University of California, Los Angeles	Env Sci/Engineer	D.Env. 2000

### APPOINTMENTS

1998 – Present	<b>Director</b> , National Ballast Information Clearinghouse
2006 – Present	<b>Research Scientist</b> , Marine Invasions Research Laboratory, Smithsonian Environmental Research Center (SERC)
2003 – Present	<b>Assistant Director/Ecologist</b> , Marine Invasions Research Lab (SERC)
2015 – Present	<b>Co-Director</b> , MarineGEO/Tennenbaum Marine Observatories Network Rhode River/Chesapeake Bay Core site Smithsonian Institution
1997 – 1998	National Sea Grant Knauss Marine Policy Fellow, Office of U.S. Senator John Glenn
1993 – 1997	Graduate Researcher, Environmental Science and Engineering Program, University of California, Los Angeles
1990 – 1992	Staff Research Associate, Psychology Dept, UCLA
1988 – 1990	Database Manager, Environmental Chemistry Divison., A.D. Little, Inc., Cambridge, MA
1985 – 1987	Laboratory Technician, Dept of Biology, Boston University
Summer 1985	<b>Field Research Assistant</b> , Hubbard Brook Experimental Forest, Department of Biology, Dartmouth College
Summers 1983, 1984	<b>Field Researcher</b> , Department of Biology/Joseph Moore Museum Earlham College

## AWARDS

- US Environmental Protection Agency Scientific and Technological Achievement Award Level II, 2014 (\*Frazier et al. 2013, *Ecological Applications*).
- SERC Director's Award: Innovation and Instrument Development, 2014.
- Dean John A. Knauss Marine Policy Fellowship, 1997. Awarded by the National Oceanic and Atmospheric Administration through the California Sea Grant Program (University of California, San Diego).
- Western Society of Naturalists Honorarium for graduate student presentation, 1997.
- College and Departmental Honors, 1984, Earlham College.
- Wendell Stanley Scholar Athlete Award, 1984, Earlham College.

## GRANTS AND CONTRACTS

### Awarded

National Ballast Information Clearinghouse operation and technical support to USCG National Ballast Water Management Program, 2016-2017. US Dept. of Homeland Security/US Coast Guard HSCG23-15-C-MMS019. PIs: Gregory M. Ruiz and **A. Whitman Miller**; FY16 = **\$2,341,037**; FY17 = **\$2,577,093**.

A Scalable MarineGEO-TMON Information System and Design Standard: Using Existing Network of Sonde, pCO<sub>2</sub>, Weather and Tide Instruments/Data Streams, 2015. Smithsonian Institution Grand Challenges Award. PIs: **A. Whitman Miller** and J. Patrick Megonigal; **\$13,300**.

Developing a coastal acidification observation network in the Chesapeake Bay. Alliance for Coastal Technologies/ International Ocean Observing System, 2013. PIs: **A. Whitman Miller** and J. Patrick Megonigal; **\$85,000**.

National Ballast Information Clearinghouse operation and technical support to USCG National Ballast Water Management Program, 2012-2015. US Dept. of Homeland Security/US Coast Guard PIs: Gregory M. Ruiz and **A. Whitman Miller**; **\$9,750,355**.

Importation of Baitworms and their Live Algal Packing Materials to the Mid-Atlantic: Vector Characterization and Management. NOAA MD Sea Grant, 4/15/2011 – 09/14/2012. PIs: **A. Whitman Miller**, April Blakeslee, Joao Canning Clode, Gregory M. Ruiz, Edwin Grosholz, Fred Dobbs, James T. Carlton; **\$221,582**.

Tracking Ecological Change from Ocean Acidification across Latitudes using Autonomous Monitoring and Manipulative Field Experiments, 2012. Smithsonian Grand Challenges Competition. PIs: **AW Miller**, Riedel FR, Ruiz GM, Megonigal JP, Breitburg D, Paul V, Collin R, Torchin M. 2012; **\$100,000**.

Spatial and temporal variations of the carbon dioxide system in coastal ecosystems. 2011-2012. Smithsonian Marine Science Network Award. PIs: **Miller AW** and GF Riedel; **\$30,000**.

The Designing the Smithsonian Institution's MarineGEO Program. 2010-11. Smithsonian Grand Challenges Consortia. PIs: **A. Whitman Miller**, J Patrick Megonigal, Richard W. Osman, Nancy Knowlton; **\$50,000**.

Effects of Acidification on in Coastal Ecosystems. 2010-11. Smithsonian Institution/ Howell Foundation. PI: A. Whitman Miller; **\$5,000**.

National Ballast Information Clearinghouse operation and technical support to USCG National Ballast Water Management Program. 2006-2011. PIs: Gregory M. Ruiz and **A. Whitman Miller**; **\$6,056,177**.

Effects of acidification on coastal habitats in Long Island Sound. Connecticut Sea Grant. 2010-2012. PIs: Robert B. Whitlatch, R.W. Osman and **A. Whitman Miller**; **\$129,365**.

Climate Change in Chesapeake Bay: Acidification, Hypoxia, and Oyster Restoration. 2009-2010. National Oceanographic and Atmospheric Administration, Chesapeake Bay Office. PIs: **A. Whitman Miller** and Gerhardt F. Riedel; **\$41,993**.

Research Opportunities Fund. Smithsonian Marine Science Network. 2009. PI: **A. Whitman Miller**; **\$3,500**.

Comparative Demographic and Genetic Investigations of two Cryptogenic Snail Populations in South Africa with Native Populations. 2008-09. Global Invasions Research Coordination Network (NSF- RCN). PIs: **AW Miller**, AMH Blakeslee, Ruiz GM and C Griffiths; **\$5,075**

National Ballast Information Clearinghouse operation and technical support to USCG National Ballast Water Management Program. 2005-2006. PIs: Gregory M. Ruiz and **A. Whitman Miller**; **\$1,071,200**.

Research Opportunities Fund. Smithsonian Marine Science Network, 2005. PI: **A. Whitman Miller**; **\$3,000**.

The effects of invasion and latitude on the demographics of two brooding marine invertebrates: implications for risk assessment modeling. 2004-05. Smithsonian Marine Science Network. PIs: **A. Whitman Miller** and Gregory M. Ruiz; **\$20,000**.

Expansion of Smithsonian Environmental Research Center Web-based Database Capabilities. Smithsonian Institution Information Resources Management Pool. 2004. PIs: **A. Whitman Miller**, Kimbra Cutlip, Donald Weller, Suzan Gunzalus, Charles Gallegos; **\$18,000**.

Tests of ANS Risk Analysis II. Population Dynamics and Demographics of US Transcoastal Invaders, National Sea Grant. 2003-05. PIs: **A. Whitman Miller**, Gregory M. Ruiz, Mark E. Torchin, James T. Carlton, Jonathan Geller; **\$216,133**.

Fine Scale Quantitative Spatial Analysis of Biofouling Communities and Effects of NIS Removal on Community Assemblage. 2004. NOAA Aquatic Invasive Species Team. PIs: Brian Mulvey, Steve Edmondson, **A. Whitman Miller**, Gregory M. Ruiz; **\$50,761**.

Eradication of the exotic snail *Littorina saxatilis* in San Francisco Bay, NOAA, 2001-2002. PIs: Gregory M. Ruiz, **A. Whitman Miller**, Jeffrey A. Crooks, Edwin Grosholz, Russell Bellmer; **\$90,000**.

Management & On-Line Access for Ballast Water Delivery and Management Data reported by Ships Arriving to Ports in the State of Washington, Washington Department of Fish and Wildlife, 2001. PIs: Gregory M. Ruiz and **A. Whitman Miller**; **\$24,078**.

#### **JOURNAL ARTICLES/ BOOK CHAPTERS**

Fowler AE, Blakeslee AMH, Canning-Clode J, Repetto MF, Phillip AM, Carlton JT, Moser FC, Ruiz GM and **AW Miller** 2015. Opening Pandora's bait box: a potent vector for biological invasions of live marine species. *Diversity and Distributions* doi: 10.1111/ddi.12376.

Muirhead JR, Minton MS, **Miller AW** and GM Ruiz 2015. Projected effects of the Panama Canal expansion on shipping traffic and biological invasions. *Diversity and Distributions* 21:75–87.

Minton MS, **Miller AW** and GM Ruiz 2015. Implications of ship types on delivery and management of ballast water. In: Canning-Clode J ed. *Biological Invasions in aquatic and terrestrial Systems: Biogeography, Ecological Impacts, Predictions and Management*. De Gruyter Open Ltd, Warsaw/Berlin, pp. 343-364.

Moser CS, Wier TP, Grant JF, First MR, Tamburri MN Ruiz GM, **Miller AW** and LA Drake 2015. Quantifying the total wetted surface area of the World fleet: a first step in determining the potential extent of ships' biofouling. *Biological Invasions 2015:1-13*.

**Miller AW** and GM Ruiz 2014. Arctic shipping and marine invaders. *Nature Climate Change* 4:413-416.

- Miller AW** 2014. Melting Sea Ice, Accelerated Shipping, and Arctic Invasions. In: *Marine invasive species in the Arctic*, TemaNord 2014:547, Nordic Council of Ministers, pp. 35-51.
- Frazier M, **Miller AW** and GM Ruiz 2013. Linking science and policy to prevent the spread of invasive species from the ballast water discharge of ships. *Ecological Applications*, 23(2):287-289.
- Ruiz GM, Fofonoff PW, Ashton G, Minton MS and **AW Miller** 2013. Geographic variation in marine invasions among large estuaries: Effects of ships and time. *Ecological Applications* 23(2):311-320.
- \*Frazier M, **Miller AW**, Lee II H and DA Reusser 2013. Counting at low concentrations: the statistical challenges of verifying ballast water discharge standards. *Ecological Applications* 23(2):339-351. (Winner of 2014 US EPA Scientific and Technological Achievement Award)
- Reusser DA, Lee II H, Frazier M, Ruiz GM, Fofonoff, PW, Minton MS, and **AW Miller** (2013). Per capita invasion probabilities: an empirical model to predict rates of invasion via ballast water. *Ecological Applications*, 23(2):321-330.
- Williams SL, Davidson IC, Pasari JR, Ashton GV, Carlton JT, Crafton RE, Fontana RE, Grosholz ED, **Miller AW**, Ruiz GM and CJ Zabin 2013. Managing multiple vectors for marine invasions in an increasingly connected world. *BioScience* 63:952-966.
- Arnold T, Mealey C, Leahey H, **Miller AW**, Hall-Spencer JM, Milazzo M, and K Maers 2012. Ocean Acidification and the Loss of Phenolic Substances in Marine Plants. *PLoS ONE* 7(4): e35107. doi:10.1371/journal.pone.0035107
- Blakeslee AMH, Altman I, **Miller AW**, Beyers JE, Hamer DE, and GM Ruiz 2012. Parasites and invasions: a biogeographic examination of parasites and hosts in native and introduced ranges. *Journal of Biogeography* 39(3):609-622.
- Miller AW**, Minton M and GM Ruiz 2011. Geographic limitations and regional differences in ships' ballast water management to reduce marine invasions in the contiguous US. *Bioscience* 61:880-887.
- Miller AW**, Frazier M, Smith GE, Perry ES, Ruiz GM and MN Tamburri 2011. Enumerating sparse organisms in ships' ballast water: Why counting to 10 is not so easy. *Environmental Science and Technology*. doi:10.1021/es102790d
- Chang AL, Blakeslee AMH, **Miller AW** and GM Ruiz 2011. Establishment failure in biological invasions: A case history of *Littorina littorea* in California, USA. *PloS ONE* 6, no. 1 (2011): e16035.

- Panova M, Blakeslee AMH, **Miller AW**, Mäkinen T, Ruiz GM, Johannesson K, and C André 2011. Survival of a North Atlantic marine snail in multiple glacial refugia: Implications for phylogeographic patterns. *PLoS ONE* 6, no. 3 (2011): e17511.
- Hoos PM, **Miller AW**, Ruiz GM, Vrijenhoek RC, and JB Geller 2010. Genetic and historical evidence disagree on likely sources of the Atlantic amethyst gem clam *Gemma gemma* (Totten, 1834) in California. *Diversity and Distributions*. 16:582-592.
- Rup MP, Bailey SA, Wiley CJ, Minton MS, **Miller AW**, Ruiz GM, and HJ MacIsaac 2010. Domestic ballast operations on the Great Lakes: potential importance of Lakers as a vector for introduction and spread of nonindigenous species. *Can. J. Fish Aquat Sci* 67:256-268.
- Miller AW**, Reynolds AC, Sobrino, and GF Riedel 2009. Shellfish face uncertain future in high CO<sub>2</sub> world: Influence of acidification on oyster larvae calcification and growth in estuaries. *PLoS ONE* 4(5): e5661. doi:10.1371/journal.pone.0005661.
- Miller AW** and GM Ruiz 2009. Differentiating Successful and Failed Invaders: Species Pools and the Importance of Defining Vector, Source and Recipient Regions. In: Rilov G and Crooks J eds. *Biological Invasions in Marine Ecosystems: Ecological, Management, and Geographic Perspectives*, Springer Verlag, pp. 153-170.
- Miller AW**, Ruiz GM, Minton MS, and RF Ambrose 2007. Differentiating successful and failed molluscan invaders in estuarine ecosystems. *Marine Ecology Progress Series* 332:41-51.
- Minton MS, Verling E, **Miller AW** and GM Ruiz 2005. Reducing propagule supply and coastal invasions via ships: effects of emerging strategies. *Frontiers in Ecology and the Environment* 3(6):304-308.
- Verling E, Ruiz GM, Smith LD, Galil B, **Miller AW** and KR Murphy 2005. Supply-side invasion ecology: characterizing propagule pressure in coastal ecosystems. *Proceedings of the Royal Society of London. Series B*. 272:1249-1257.
- Miller AW**, Chang AL, Cosentino-Manning N and GM Ruiz 2004. A new record and eradication of the northern Atlantic alga *Ascophyllum nodosum* (Phaeophyceae) from San Francisco Bay, California, USA. *Journal of Phycology* 40(6):1028-1031.
- Hines AH, **Miller AW**, Ruiz GM and K Lion 2004. Estimating domestic and foreign ballast water as a vector for invasive species: Regional analysis for New England, northeast North America. Pp. 47-54 in Pederson, J. (editor). *Exploring areas within the EEZ where ballast water ballast water exchange is environmentally and economically feasible*. Proceedings of the Ballast Water Workshop, October 27-28, 2003. MIT Sea Grant College Program, Cambridge, MA.

**Miller AW**, Hewitt CL and GM Ruiz 2002. Invasion success: does size really matter? *Ecology Letters*, 5:159-162.

**Miller AW** 2000. Assessing the importance of biological attributes for invasion success: eastern oyster (*Crassostrea virginica*) introductions and associated molluscan invasions of Pacific and Atlantic coastal systems [dissertation]. Los Angeles (CA): University of California. 210 p. Available from: University Microfilms, Ann Arbor, MI; UMI Number 9993018.

**Miller AW** and RF Ambrose 2000. Sampling patchy distributions: comparison of sampling designs in rocky intertidal habitats. *Marine Ecology Progress Series* 196:1-14.

**Miller AW**, Ruiz GM, Takata L, Steves B and AH Hines 2000. Measuring ballast water delivery and management patterns in the United States: the National Ballast Information Clearinghouse and National Ballast Survey. In: Pederson, J, editor. *Marine Bioinvasions: Proceedings of the First National Conference*; Jan 24-27, 1999; Cambridge: Massachusetts Institute of Technology, MIT Sea Grant College Program. P 303-315.

**Miller AW** and RF Ambrose 1994. Malibu Lagoon Birds. In: Ambrose RF, IW Suffet and SS Que Hee, Enhanced Environmental Monitoring Program at Malibu Creek and Malibu Lagoon, Report to Las Virgenes Municipal Water District.

Cuevas ME, **Miller W** and G Callard 1992. Sulfoconjugation of steroids and the vascular pathway of communication in dogfish testis. *Journal of Experimental Zoology* 264:119-129.

**Miller AW** and DP Young 1985. Breeding Bird Censuses. *American Birds* 39:112.

**Miller AW** 1984. Breeding Bird Censuses. *American Birds* 38:126-127.

**Miller AW** and DP Young 1984. New geographical distribution record for the stinkpot turtle, *Sternotherus odoratus*. *Herpetological Review* 15(3):77.

## SELECTED TECHNICAL REPORTS AND OTHER PUBLICATIONS

### National Ballast Information Clearinghouse Biennial Reports

Minton MS, Huber T, Ruiz GM, and **AW Miller**. 2015. Status and trends of ballast water management in the United States. Eighth biennial report (part 1) of the National Ballast Information Clearinghouse (January - December 2014).

Minton MS, Huber T, Ruiz GM, and **AW Miller**. 2014. Status and trends of ballast water management in the United States. Seventh biennial report (part 2) of the National Ballast Information Clearinghouse (January - December 2013).

Minton MS, Huber T, Ruiz GM, and **AW Miller**. 2013. Status and trends of ballast water management in the United States. Seventh biennial report (part 1) of the National Ballast Information Clearinghouse (January - December 2012).

Minton MS, Huber T, Ruiz GM, and **AW Miller**. 2012. Status and trends of ballast water management in the United States. Sixth biennial report of the National Ballast Information Clearinghouse (January 2010 - December 2011).

**Miller AW**, Huber T, Minton MS, and GM Ruiz. 2012. Status and trends of ballast water management in the United States. Fifth biennial report of the National Ballast Information Clearinghouse (January 2008 - December 2009).

**Miller AW**, Huber T, Minton MS, and GM Ruiz. 2011. Status and trends of ballast water management in the United States. Fourth biennial report of the National Ballast Information Clearinghouse (January 2006 - December 2007).

**Miller AW**, Lion K, Minton MS, and GM Ruiz. 2007. Status and trends of ballast water management in the United States. Third biennial report of the National Ballast Information Clearinghouse (January 2004 - December 2005).

**Miller AW**, Lion K, and GM Ruiz. 2004. Status and trends of ballast water management in the United States. Second biennial report of the National Ballast Information Clearinghouse (January 2002 - December 2003).

Ruiz GM, **Miller AW**, Lion K, Steves B, Arnwine A, Collinetti E, and E Wells. 2001. Status and trends of ballast water management in the United States. First biennial report of the National Ballast Information Clearinghouse (July 1999 - June 2001).

### Other Selected Technical Reports

Wakeley EF, Minton MS, Huber T, **Miller AW**, and GM Ruiz. 2015. Status of National Ballast Information Clearinghouse initiative PWS 5.3: coordinated outreach to vessels. 2013-2014 Annual Report. Submitted to the USCG.

- Wakeley EF, Minton MS, Huber T, **Miller AW**, and GM Ruiz. 2015. Status of NBIC coordinated outreach to vessels (PWS 5.3) – 2014-2015 Annual Report. Submitted to the USCG.
- Miller AW**, Megonigal JP and MN Tamburri 2014. Science assessment of Chesapeake Bay acidification: Toward a research and monitoring strategy. Workshop proceedings Alliance for Coastal Technologies [UMCES] CBL 2014-52 ACT WS01-14, 26pp.
- Minton MS, Ruiz GM, and **AW Miller**. 2014. Opportunities and constraints for the treatment of coastwise ballast water discharged in the United States. Final Report for PWS 5.8.
- Wakeley EF, Minton MS, Huber T, **Miller AW**, and GM Ruiz. 2013. Status of National Ballast Information Clearinghouse initiative PWS 5.3: coordinated outreach to vessels. 2012-2013 Annual Report. Submitted to the USCG.
- Bertram CR, Wakeley EF, Minton MS, Huber T, **Miller AW**, and GM Ruiz. 2012. Status of National Ballast Information Clearinghouse initiative PWS 5.3: coordinated outreach to vessels. Annual Report – Oct 2012. Submitted to the USCG.
- Minton MS, **AW Miller**, and GM Ruiz. 2012. Ballast water flux into the Laurentian Great Lakes by coastwise and transoceanic voyages. Submitted to the Cooperative Institute for Limnology and Ecosystems Research.
- Miller AW**, and GF Riedel 2010. Native oyster restoration in a high CO<sub>2</sub> world: Effects of estuarine acidification on oyster calcification, growth, and recruitment. Report to NOAA Chesapeake Bay Office.
- Miller AW**, Ruiz GM, Torchin ME, Carlton JT 2007. Tests of ANS Risk Analysis II: Population dynamics and demographics of US transcoastal invaders (R/IS-16) - Final Performance Report (Aug 2007), MD Sea Grant.
- Ryan K and **AW Miller** 2007. Operation of the National Ballast Information Clearinghouse: A day in the life of a Ballast Water Report. United States Coast Guard Environmental Standards Update Newsletter, Summer 2007.
- Gilborn A and **AW Miller** 2006. US Coast Guard and Smithsonian Institution work together to reduce risk of marine invasions. United States Coast Guard Environmental Standards Update Newsletter, Fall 2006.
- Ruiz GM, **Miller AW**, Everett RA, Steves B, Lion K, Whitcraft C, Arnwine A, Collinetti E, Sigala M and D Lipski 2000. Results from the first year of data management and analysis: Shipping industry compliance with mandatory ballast water reporting requirements / shipping industry compliance with voluntary ballast water management guidelines. National Ballast Information Clearinghouse interim report to the U.S. Coast Guard. 30 pp.

Ruiz GM, **Miller AW**, Takata L and L Kurzava 1998. The National Ballast Information Clearinghouse: function, design, and implementation, Progress Report I. Report to U.S. Coast Guard and U.S. Congress, 34 pp.

Ruiz GM, **Miller AW** and WC Walton 1998. The bi-coastal invasion of North America by the European green crab: impacts and management strategies. Aquatic Nuisance Species Task Force, Smithsonian Environmental Research Center, Edgewater, Maryland, USA pp. 45pp.

**Miller AW** 1997. Senator John Glenn's floor speech introducing the Great Lakes Fish and Wildlife Restoration Act of 1997 (S. 659). Congressional Record, Proceedings and Debates of the 105th Congress 143(51):S3735-S3736.

## SELECTED RECENT MEDIA COVERAGE AND NEWS PROFILES

Dec 2015

Arctic ocean acidification research collaboration with Ocean Research Project featured in *Cruising World*.

Autumn 2015

Featured in "Virginia Climate Fever", winner of the American Institute of Physics 2015 Science Writing Award for Books (Stephen Nash, author).

Posted on: 28 May 2014

### [Melting Arctic opens new passages for invasive species](#)

For the first time in roughly 2 million years, melting Arctic sea ice is connecting the north Pacific and north Atlantic oceans. The newly opened passages leave both coasts and Arctic waters vulnerable to a large wave of invasive species, biologists assert  
*Science Daily*

Posted on: 28 May 2014

### [Warning: New Arctic Shipping May Lead to Invasive Species Spread](#)

Experts are warning that the new Arctic shipping routes that have opened up as ice-ways continue to melt create new opportunities for invasive marine and insect life to spread further north.

*Nature World News*

Posted on: 29 May 2014

### [Arctic Shipping: Good For Invasive Species, Bad For the Rest of Nature](#)

A pair of Smithsonian marine biologists argue that a warming Arctic puts the area at risk for inviting invasive species

*Smithsonian Magazine*

Posted on: 29 May 2014

**[1<sup>st</sup> time in 2 mn years, melting Arctic ice threatens mass-scale species contamination](#)**

The world is entering the most significant period of invasive species contamination in two million years as Arctic ice melts away and new shipping routes threaten to open the floodgates between foreign eco systems, causing irreversible damage.

*RT.com*

Posted June 2, 2014

**[Melting sea ice means new opportunities for biological invasions](#)**

Arctic ice is melting. You knew that already. What you perhaps didn't know is what the melting ice means for the possibility of biological invasions into the northern latitudes. For the first time in several million years, the melting of the Arctic sea ice has connected the North Pacific and North Atlantic Oceans.

*ConcervationMagazine.org*

Posted Jan 7, 2014

**[With increase in shipping, Arctic braces for influx of invasive species](#)**

Arctic ice is melting. You knew that already. What you perhaps didn't know is what the melting ice means for the possibility of biological invasions into the northern latitudes. For the first time in several million years, the melting of the Arctic sea ice has connected the North Pacific and North Atlantic Oceans.

*Arctic Newswire*

Posted March 2012

**[Acid Test for Great Shellfish Bay?](#)**

As CO<sub>2</sub> levels are rising in the atmosphere, acidity levels are rising in the ocean, which may be slowing growth rates for coral reefs, oysters, and other shell-building species. Could changes in acidity threaten the survival of oysters in the Chesapeake Bay at a time when oyster farming here is on the rise?

*Chesapeake Quarterly*

Summer 2012

“Ecosystems on the Edge” video on Ocean Acidification in coastal ecosystems.

Summer 2012

“Chemistry at the Smithsonian” video on Ocean Acidification in coastal ecosystems.

## PRESENTATIONS/ INVITED LECTURES

**Miller AW.** Coastal and Estuarine OA Monitoring in the Mid-Atlantic and Southeast US. CERF Coastal OA Town Hall Meeting, Portland, OR. November 11, 2015

Arnold T and **AW Miller.** Carbonate System Fluctuations within Seagrass Meadows and Implications for Coastal Acidification. Coastal & Estuarine Research Federation, Portland, OR. November 9, 2015.

**Miller AW.** Striving to Comprehend Coastal Ocean Acidification: A Role for Innovation? Castle Lecture Series - Innovation for a Small Planet. Smithsonian Institution, Washington, DC. October 15, 2015

**Miller AW.** An overview of Coastal Ocean Acidification Monitoring and Measurement. Congressional Ocean Caucus Visit/presentation, August 28, 2015.

**Miller AW.** Coastal Ocean Acidification:  $pCO_2$  Instrument Design and Data Collection. Congressional Ocean Caucus. Smithsonian Environmental Research Center, Edgewater, MD. June 22, 2015.

**Miller AW.** MarineGEO/TMON Data Management: Some Brief Thoughts and a Cautionary Tale. SERC MarineGEO/TMON Core Site Meeting, 14 April 2015.

**Miller AW.** Environmental Topics of Concern and Research in Chesapeake Bay. World Harbours Project Workshop, Sydney Institute of Marine Sciences, Sydney Australia, Nov 11-13, 2014.

**Miller AW.** Living in the Anthropocene: Prospects for climate, economics, health, and security. SI Grand Challenges Consortia. Invited expert panelist. SI Baird Auditorium, November 9, 2014.

**Miller AW.** National Ballast Information Clearinghouse Program Review, Smithsonian Environmental Research Center, Edgewater, MD. October 2014.

**Miller AW** and A Reynolds: SERC Open House Exhibits: 1) Coastal Ocean Acidification,  $pCO_2$  Measurements and Monitoring; 2)  $CO_2$  as an Indoor Air Quality Measurement. Edgewater, MD autumn, 2014.

**Miller AW.** Some Considerations for Monitoring Acidification in Chesapeake Bay. Governor's Task Force to Study the Impact of Ocean Acidification on State Waters. Maryland DNR, Annapolis, MD. 07 August 2014.

**Miller AW.** Coastal Acidification: Carbon Chemistry Dynamics in Chesapeake Bay. Climate Change Science Seminar for Journalists - Metcalf Institute for Marine & Envir. Reporting, Pulitzer Center on Crisis Reporting, Woodrow Wilson Center, Washington, DC. April 24, 2014.

**Miller AW** and GM Ruiz. Melting Sea Ice, Accelerated Shipping, Inter-Ocean Corridors. JimFest 14, Edgewater, MD. 10 April 2014.

**Miller AW**, Reynolds A and FGF Riedel. Coastal Monitoring: Measuring Carbonate Chemistry in the Rhode River, MD. Science Assessment of Chesapeake Bay Acidification Workshop IOOS-NOAA/ACT/SERC. Edgewater, MD. 11 March 2014.

**Miller AW**. Melting Sea Ice, Accelerated Shipping, and Arctic Invasions: Polar Manifest Destiny or Sustainable Development? Marine Invasive Species in the Arctic: Management Issues Workshop. Esbjerg, Denmark 24-26 October 2013.

**Miller AW**, Fowler A, Blakeslee A, Canning-Clode J, Ruiz GM and F Moser. Importation of Baitworms and Algae Packing Materials to the Mid-Atlantic: Vector Characterization and Management (Part #1). *Ascophyllum*/Baitworm Workshop, Edgewater, MD. March 15, 2013.

**Miller AW**. Ocean Acidification: Challenges of Coastal Ecosystems. pH Sensor Field Protocol Development Workshop; Alliance for Coastal Technologies, Ann Arbor, MI, June 26-28, 2013

**Miller AW**. Acidification in Coastal Ecosystems. Hypoxia Group Meeting, Edgewater, MD. Dec 18, 2013.

**Miller AW**, Riedel GR and KJ Klug. MarCO<sub>2</sub>m (Marine CO<sub>2</sub> Monitor): Portable pCO<sub>2</sub> Measuring Device for Ocean Acidification Monitoring. Presentation to SI Office of General Counsel and SI Enterprises. Dec 8, 2012.

**Miller AW**, Reynolds A and GF Riedel. Monitoring Acidification and Carbonate Chemistry Dynamics in Chesapeake Bay and Other Coastal Ecosystems. Poster presented at Maryland Water Monitoring Council Annual Meeting. Dec 2012.

**Miller AW**. Ocean Acidification: Challenges of Coastal Ecosystems. Chesapeake Bay Laboratory Seminar Series. Nov 28, 2012.

**Miller AW**. Ocean and Coastal Acidification Research at SERC; prepared for Secretary Clough's visit. Nov 16, 2012.

**Miller AW**. Chesapeake Research Consortium Board of Directors Meeting, Aug 2012. SERC Advisory Board Meeting, Seattle, WA, Sept 7-8, 2012.

**Miller AW**. "Meet the Scientist" presentation to elementary students as part of the SERC Education Summer camps, summer 2012.

**Miller AW**. Represented SERC scientists and helped host a team of students and a professor from Austria, Summer 2012.

**Miller AW.** Sustainable Seafood Festival (Ocean Acidification station hands-on presentation), NMNH, June 2012.

**Miller AW.** NBIC Program Review, United States Coast Guard Headquarters, May 18, 2012.

**Miller AW.** ANSTF Meeting, Annapolis, MD, May 2012.

**Miller AW.** Grand Challenges: Designing Tracking Ecological Change from Ocean Acidification across Latitudes using Autonomous Monitoring and Manipulative Field Experiments. Hirshhorn Museum and Sculpture Garden, Wash DC. May 2012.

**Miller AW.** Coastal Acidification: Carbon Chemistry Dynamics in Chesapeake Bay MarineGEO Workshop, Annapolis, MD, Nov 2011.

**Miller AW.** NBIC Program Review, United States Coast Guard Headquarters, Nov 2011.

**Miller AW.** Global Greenship 2011, MarineLog Conference and Expo, Baltimore, MD. Sept 15-16, 2011.

**Miller AW.** Seventh International Conference on Marine Bioinvasions, Barcelona, Spain. Aug 21-23, 2011.

**Miller AW.** Smithsonian Climate Change Symposium, National Museum of Natural History, Washington DC. May 24, 2011.

**Miller AW.** Grand Challenges: Designing SI's Marine Global Environmental Observatory, Hirshhorn Museum and Sculpture Garden, Wash DC. May 18, 2011.

**Miller AW.** Great Lakes Ballast Water Cooperative, Toronto, ON. Jan 18, 2011.

**Miller AW.** U.S. Coast Guard–Naval Research Laboratory Semi-Annual Program Review, Washington, DC. Nov 18, 2010

**Miller AW.** Accounting for Carbon: MarineGEO Coastal Carbon Network. National Museum of Natural History, Washington, DC. Nov 10, 2010.

**Miller AW.** DePauw University, Greencastle, IN. October 6, 2010.

**Miller AW** Modeling ballast water treatment technology efficacy under USCG Phase I/ IMO D2. US Coast Guard-Naval Research Laboratory Program Review, Washington, DC, Nov 18, 2010.

**Miller AW**, Megonigal JP, Collin R, Christy J, Lessios HA, Cairns SD, Osman RW, and H Guzman. Accounting for Carbon: MarineGEO Coastal Carbon Network. MarineGEO Open Forum, National Museum of Natural History, Smithsonian Institution, Washington, DC, Nov 10, 2010.

**Miller AW**. Ocean acidification: Why coastal ecosystems are different. DePauw University, Greencastle, IN Oct 6, 2010.

**Miller AW**, Smith G, Tamburri M and GM Ruiz. Investigating IMO/USCG Phase I Zooplankton BW Discharge Standards, STEP Workshop, Volpe Transportation Research Center, Cambridge, MA, April 7-8, 2010.

**Miller AW**, Effects of elevated CO<sub>2</sub> on two oyster species under estuarine conditions. Ocean Sciences Meeting, Portland, OR, Feb 26, 2010.

**Miller AW**, Effects of elevated CO<sub>2</sub> on two oyster species under estuarine conditions. Aquaculture 2010, San Diego, CA, Mar 3, 2010.

**Miller AW**, Minton MS and GM Ruiz. Commercial Shipping and Invasion Opportunity in North America. Aquatic Invasive Species Mid-Atlantic Regional Workshop 2009 - Vector Management: A Prevention Solution, Baltimore, MD, December 2, 2009.

**Miller AW**, Minton MS and GM Ruiz. Shipping in North America: Implications for Marine Bioinvasions. International Workshop on Marine Invasions. Smithsonian Tropical Research Center, Panama City, Panama, November 16-18, 2009.

**Miller AW**. Measuring Calcification in Biological Experiments – Mollusks. OCB/EPOCA Ocean Acidification Course. Woods Hole, MA, November 2-13, 2009.

**Miller AW**. Marine Invasions Research: Ships as Vectors. Smithsonian Environmental Research Center Advisory Board Meeting, Edgewater, MD, October 23, 2009.

**Miller AW**. Shellfish Face Uncertain Future in High CO<sub>2</sub> World: Influence of Acidification on Oyster Larvae Calcification and Growth in Estuaries. Virginia Institute of Marine Science Eastern Shore Laboratory, Wachapreague, VA, August 05, 2009.

**Miller AW**. Shellfish Face Uncertain Future in High CO<sub>2</sub> World: Influence of Acidification on Oyster Larvae Calcification and Growth in Estuaries. Center for Coastal Physical Oceanography, Old Dominion University, April 09, 2009.

**Miller AW.** CO<sub>2</sub>-induced acidification in estuaries: differential effects in larval oyster growth/ calcification. Distinguished Scholar Seminar Speaker, University of Maryland Center for Environmental Science Chesapeake Biological Laboratory, Solomons, MD, Oct 22, 2008.

**Miller AW,** Blakeslee A and GM Ruiz. Comparative demographic and genetic investigations of two cryptogenic snail populations in South Africa. Czech University of Life Sciences, Prague, Czech Republic, Sept 22, 2008.

**Miller AW.** The effects of estuarine acidification on *C. virginica* and *C. ariakensis*, Chesapeake Research Consortium Board Meeting, Edgewater, MD, June 25, 2008.

**Miller AW** and GM Ruiz. A scientific look at invasive species and ballast water management. Marine Log Global GreenShip Conference and Expo, Washington, DC, Sept 20-21, 2007.

**Miller AW.** Marine Invasive Species, Shipping, Federal Legislation and Regulation. Howard University Teachers and Fellows Program, Smithsonian Environmental Research Center, Edgewater, MD, August 6, 2007.

**Miller AW,** Ruiz GM and I Davidson. Marine Invasive Species and Shipping - Their Importance for Antifouling Technologies. National Paint and Coatings Association: International Marine & Offshore Coatings Conference. Virginia Beach, VA, June 18-20, 2007.

**Miller AW,** Minton MS, Ryan K and GM Ruiz. Shipping vectors in the Gulf of Mexico and Caribbean. Gulf of Mexico Marine Invasive Species Workshop. Harte Research Institute for Gulf of Mexico Studies and Smithsonian Environmental Research Center, Texas A&M University, Corpus Christi, TX, February 26-27, 2007.

Lynne Fegley and **Miller AW.** Mitten crabs in Maryland? Response to a new potential invasive. Report to the Aquatic Nuisance Species Task Force, Arlington, VA, November 7-9, 2006.

Minton MS, **Miller AW** and GM Ruiz. Great Lakes Shipping and Ballast Patterns. Great Lakes Ballast Water Conference Targeting Technology, Chicago, IL, Sep 27, 2006.

**Miller AW** and GM Ruiz. Marine Invasions Research at SERC: Ships as vectors. Womens' International Shipping and Trade Association, Washington D.C. Chapter, Smithsonian Environmental Research Center, Edgewater, MD October 23, 2006.

**Miller AW** and P. Fofonoff. Web-based Nonindigenous Species Databases. Mid-Atlantic Regional Panel on Aquatic Invasive Species, Annapolis, MD, September 13-14, 2006.

**Miller AW.** Marine Invasions Research at the Smithsonian Environmental Research Center. Global Invasions Research Coordination Network, 1st Annual Meeting, Fort Collins, CO, August 15-17, 2006.

**Miller AW.** Invited lecture, Department of Biology, Franklin and Marshall College, Lancaster, PA, April 6, 2006.

**Miller AW.** Invited lecture, Environmental Sciences and Resources Program, Portland State University, Portland, OR, March 7, 2006.

**Miller AW,** Torchin M, Wells E, Altman I and GM Ruiz. Does Native Ecology Predict Invasion Ecology? Comparative Demographics of Invertebrates across Coasts. Fourth International Marine Bioinvasions Conference, Wellington, New Zealand, August 24-26, 2005.

**Miller AW.** Regional Approaches to Invasive Species: Aquatic Bioinvasions Research and Policy Institute (PSU & SERC). Pacific Northwest Economic Region 15th Annual Summit, Seattle, WA, July 14-17, 2005.

**Miller AW.** Characterizing U.S. Ballast Delivery Patterns: Volumes, Time Constraints. Workshop for Evaluating Ballast Water Treatment Systems Onboard Ships: Technical and Scientific Approaches, Portland, OR, June 14-15, 2005.

**Miller AW** and GM Ruiz. Smithsonian Institution: NIS Activities, FY04. Report to the Aquatic Nuisance Species Task Force, Arlington, VA, November 16-17, 2004.

**Miller AW** and GM Ruiz. Marine Invasions Prevention: a legislative overview. Teachers's Training Workshop, Smithsonian Environmental Research Center, Edgewater, MD, October 8, 2004.

**Miller AW.** The importance of biological invasion on molluscan ecology and biodiversity: a 21st century perspective. Plenary Speaker, Ecology Symposium of the World Congress of Malacology, Perth, Western Australia, June 11-16, 2004.

**Miller AW.** Marine Invaders of North America: Pathways and Patterns. Evenings at Whitney Public Lecture Series. Co-sponsored by the University of Florida Whitney Laboratory, Guana Tolomato Matanzas National Estuarine Research Reserve, South Carolina Sea Grant, Saint Augustine, Florida, June 12, 2003.

**Miller AW**, Ambrose RF and GM Ruiz. Predictors of Molluscan Invasion Success? - Analysis and Modeling of Commercial Oyster Transplants as a Vector for Marine Invaders. Third International Conference on Marine Bioinvasions. Scripps Institution of Oceanography, La Jolla, California, March 16-19, 2003.

**Miller AW**, Fofonoff P, Smith N, Cowan S and GM Ruiz. Marine Invaders of Florida Coastal Waters: Current Investigations of the Smithsonian Environmental Research Center. Invasive Species in Florida's Saltwater Systems: Where We Are and Where We're Going. Tampa Bay, Florida, November 5-6, 2002.

**Miller AW**. Commercial Shipping Patterns, Ballast Water Delivery, and Ballast Water Management in the United States: The National Ballast Information Clearinghouse. United States-Russia Invasive Species Workshop. Borok, Russia, August 27-31, 2001.

**Miller AW**. Ballast Water Exchange Efficiency. U. S. Coast Guard Research and Development Center Ballast Water Treatment Standards Workshop, Mystic, CT, April 17-19, 2001.

Collinetti E, **Miller AW**, Ruiz GM, Steves B and P. Fofonoff. SERC Marine Invasion Research Laboratory: Quantifying invasion patterns and processes (poster). Second International Conference on Marine Bioinvasions, New Orleans, LA, April 9-11, 2001.

**Miller AW**. Workshop for Preventing the Introduction and Spread of Aquatic Invasive Species in North America, Commission for Environmental Cooperation (invited participant), Montreal, Ontario, Canada, March 28-30, 2001.

**Miller AW**. Living Among Oysters – the Commercial Oyster Industry as a Vector for Molluscan Introductions: a Retrospective Analysis of Invasion Success and Failure. Annual Meeting of the American Society of Limnology and Oceanography, Copenhagen, Denmark, June 5-9, 2000.

**Miller AW**. Marine Invasions Biology at the Smithsonian Environmental Research Center. Center for Marine Conservation Workshop, Virginia Beach, VA, May 16, 2000.

**Miller AW**. Progress Report on the National Ballast Information Clearinghouse. Aquatic Nuisance Species Task Force Meeting, Arlington, VA, December 1, 1999.

**Miller AW**. Overview of current research on NIS and ballast water by the Smithsonian Environmental Research Center and the National Ballast Information Clearinghouse. Exotic Species Workgroup Meeting, U.S. Fish and Wildlife - Chesapeake Bay Field Office, Annapolis, MD, November 10, 1999.

**Miller AW**. Nonindigenous species in the Gulf of Mexico and in Ballast Water. Workshop on Invasive Species and Ballast Water Management in the Gulf of Mexico Region. Gulf of Mexico Program and Louisiana Sea Grant College, New Orleans, LA, October 1999.

**Miller AW.** Measuring Ballast Water Exchange Patterns: The National Ballast Survey (NABS). National Conference on Marine Bioinvasions, MIT Sea Grant College Program. Massachusetts Institute of Technology, Cambridge, MA, January 24-27, 1999.

**Miller AW.** National Ballast Survey Training Session, U.S. Coast Guard and Smithsonian Environmental Research Center, Yorktown, VA, January 13-14, 1999.

**Miller AW.** Ecological and Economic Impacts of Marine and Estuarine Invasive Species. U.S. Fish and Wildlife Service Forum on Ecological Surveys of Aquatic Nuisance Species. Smithsonian Environmental Research Center, Edgewater, MD, April 20-21, 1998.

**Miller AW et al.** The USA National Ballast Information Clearinghouse. Joint Meeting of the International Council for the Exploration of the Sea/Intergovernmental Oceanographic Commission/International Maritime Organization, The Hague, The Netherlands, March 23-27, 1998.

**Miller AW et al.** Ballast Research at the Smithsonian Environmental Research Center. Joint Meeting of the International Council for the Exploration of the Sea/Intergovernmental Oceanographic Commission/International Maritime Organization. The Hague, The Netherlands, March 23-27, 1998.

**Miller AW.** Ecological expertise on the Hill: Can ESA make it better? Ecological Society of America Annual Meeting. Albuquerque, NM, August 10-14, 1997.

**Miller AW and RF Ambrose.** Comparison of sampling design efficiency and effectiveness in rocky intertidal habitats of southern California. Western Society of Naturalists Annual Meeting. La Paz, Baja Mexico, January 9-11, 1997.

#### **MEETINGS ORGANIZED & SPONSORED (2011-2015)**

- MarineGEO Data Management meeting, Edgewater, MD. April 2015.
- Acidification in Chesapeake Bay, Edgewater, MD (30 participants). Apr 2014.
- ANSTF Meeting Tour of SERC (48 visitors), May 2012.
- MD Sea Grant Baitworm Vector meeting (10 visitors), spring 2012.
- MarineGEO Workshop, Annapolis, MD (50 participants). Nov 2011.

## SERVICE

- Interagency Working Group on Ocean Acidification (IWG-OA), Smithsonian Institution Representative (Nov 2015 – present).
- International Conference on Marine BioInvasions, Steering Committee Member (2008 – present).
- Interagency Arctic Invasive Species Working Group, Member (2015 – present).
- Interagency Federal Task Force on Aquatic Nuisance Species (ANSTF), Ex-Officio member (Mar 2004 - present).
- Smithsonian Environmental Research Center IT Hiring Committee, member (Jan 2006 – 2014).
- Smithsonian Environmental Research Center Mathias Lab Video Conferencing Design and Scoping Committee, member (Jan 2013 – 2015)
- Smithsonian Environmental Research Center Biosecurity Committee, member (Jan 2006 – present)
- Smithsonian Institution Collections Task Force, member (Jan 2004 - present).
- Smithsonian Museum Support Center Safety Committee, SERC representative (Jun 2005 – present).
- Smithsonian Environmental Research Center Information Technology Committee, member (Jan 2004 - present).
- U.S. EPA Office of Policy, Economics and Innovation and Office of Water. The Economic Impacts of Aquatic Invasive Species Workshop (invited expert in ecology). Washington, D.C., July 20-21, 2005.
- Smithsonian Environmental Research Center Ad Hoc Committee on Career Paths in Science, member (Mar 2004 – Aug 2005).
- Smithsonian National Museum of Natural History/National Oceanic and Atmospheric Administration Oceans Hall Exhibit Developmental Workshop, June 3-4, 2003.
- Supervisor/ Mentor of Smithsonian Environmental Research Center Interns.

- Journal Reviewer/ Referee: *Nature*, *Ecology Letters*, *Limnology and Oceanography*, *American Malacological Bulletin*, *Journal of Experimental Biology and Ecology*, *Journal of the Marine Biological Association*, *Marine Pollution Bulletin*, *PLoS ONE*, *J. Marine Biological Association of the United Kingdom*, *Diversity and Distributions*, *Biological Invasions*, *Marine Ecology Progress Series*, *Journal of Shellfish Research*, *Estuaries and Coasts*, *Global Change Biology*, *Ecosphere*.

## **TEACHING/ MENTORING EXPERIENCE**

Supervisor/ Mentor:

- Smithsonian Environmental Research Center (2000-2016)
  - 35 undergraduate interns/ technicians
  - 15 post-doctoral fellows

Teaching Assistant:

- Department of Organismic Biology, Ecology, and Evolution, UCLA
  - Ecology Fall 1996
  - Ecology, Evolution and Behavior Fall 1992, Winter & Spring 1994
  - Introductory Biology Winter & Fall 1993
  - Animal Physiology Spring 1993
- Biology Department, Earlham College
  - Ornithology Spring 1983, 1984
  - Ecological Biology Fall 1983

## **RESEARCH INTERESTS**

**Ecology of marine and estuarine invasive species:** comparative demographics of nonindigenous invertebrates; trait-based differentiation of successful and failed invaders, invasive species management and eradication. Relating commercial shipping, ballast water, hull fouling with patterns marine invasion. **Coastal ocean acidification:** experimental effects of elevated pCO<sub>2</sub> on organism's performance and ecology in lab and field experiments; environmental monitoring of carbonate chemistry in coastal systems as it relates to land-sea interface and biological forcing; pCO<sub>2</sub> instrument development.